

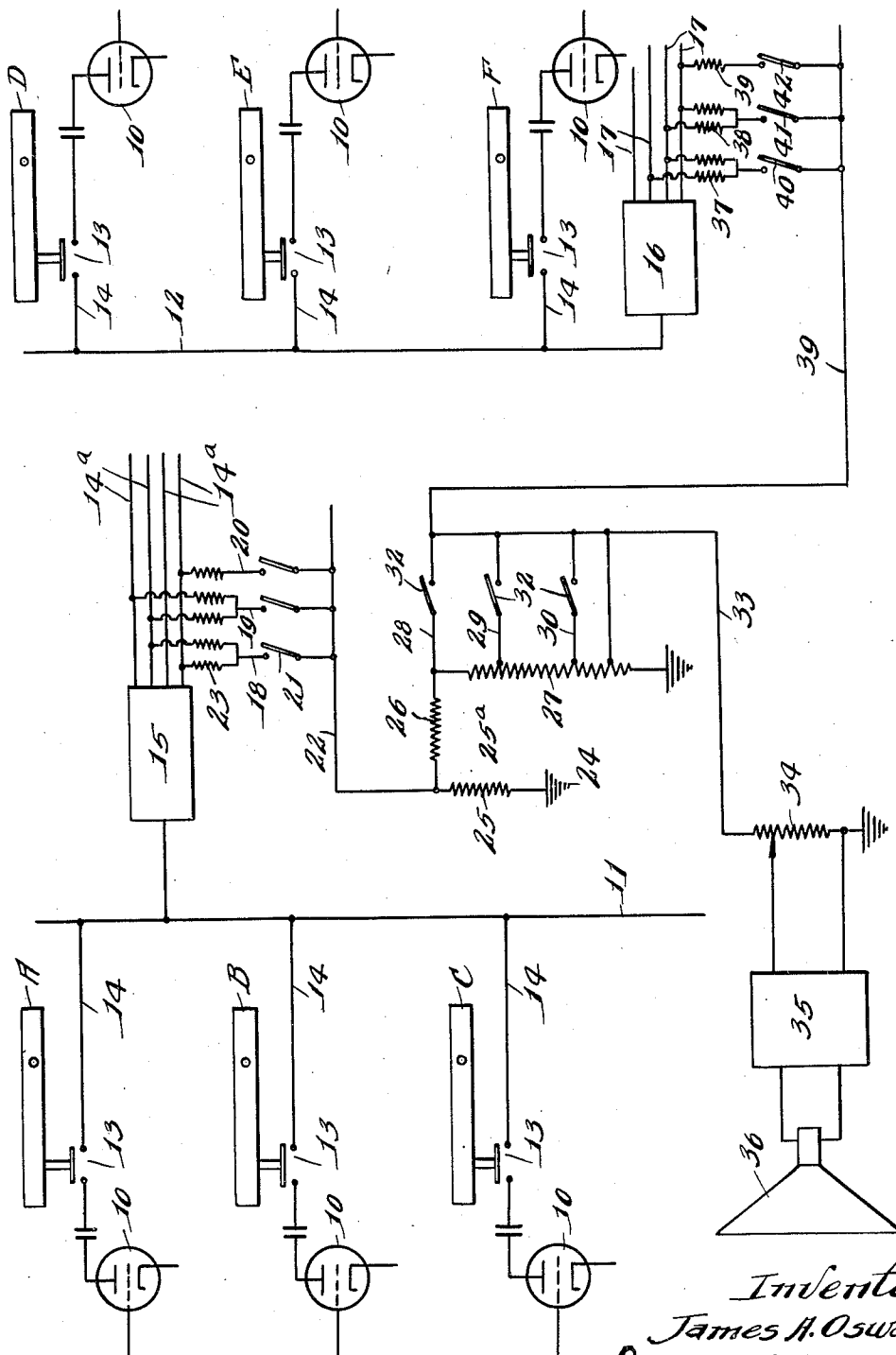
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MUSICAL INSTRUMENT

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MUSICAL INSTRUMENT

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This invention relates to electrical musical instruments employing waveform generators producing complex waveforms of oscillations at the tone frequencies of different notes of a musical scale, and means responsive to depression of selectors for translating said oscillations into audible sounds for musical expression.

In musical instruments known in the art as electric and electronic organs no provision has heretofore been made for grading the amplitude of pedal tones relative to the different "stops" of one or more manuals. In such instruments oscillations effective in an electrical network in response to actuation of the pedals and oscillations effective in said network in response to actuation of the playing-keys of said manuals are all thereof impressed upon the input circuit of a volume or expression control device of a sound translating system. In consequence thereof certain manual stops cannot be balanced or proportioned relative to given pedal stops as is necessary for discriminating results. If, for example, a manual stop is drawn for a soft string, and a pedal stop is drawn for a flute, the latter being the heavier of the two, the manual tone will be overbalanced by the pedal tone. It is this overbalancing effect prevalent in instruments of the prior art that has greatly detracted from an organist's ability otherwise to satisfactorily perform on said instruments.

An object of my invention is the provision of means for overcoming the aforementioned defects in instruments of the prior art, which said means is selectively controlled from the console in a manner enabling a wide range of amplitude variations in any pedal tone desired to be used with any manual tone.

Another object is the provision of an intensity control for electric or electronic organs the true counterpart of which is found only in the more expensive types of pipe organs.

A still further object is the provision of an intensity control for the pedal tones of an electric or electronic organ which will not contribute materially to the cost of production of the instrument and will be readily actuatable at the will of the player substantially in the same manner as drawing and retiring stops.

A more specific object is the provision of an intensity control for the pedals of a pedal keyboard adapted to be incorporated in an electrical network in a manner enabling any desired gradation in intensity of pedal tones to be had and tone producing oscillations impressed upon the input circuit of a volume control device connected in

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circuit with the manual or manuals of the instrument, whereby when operating said volume control device to vary the overall volume a proper balancing of tones is assured.

Other objects will manifestly appear upon reference to the following specifications and drawings, in which the single figure is a schematic view of the essential characterizing features of my invention.

In the accompanying drawings, A, B and C schematically represent three pedals of a pedal keyboard. D, E and F represent three playing-keys of a single manual of the instrument. Two or more manuals can of course be employed without departing from the spirit and intention of my invention. The said pedals are associated with consecutive notes of the chromatic scale and likewise is this true of the manual playing-keys.

Each separate manual playing-key and each separate pedal is electrically connected with an individual source of oscillations such as vacuum tube 10 or its functional equivalent.

The electrical network herein disclosed is provided with a conductor 11 which is common to all generators 10 associated with the aforementioned pedals A, B and C. A similar conductor 12 is common to all generators 10 associated with the playing-keys D, E and F of said manual. Each of said generators 10 is coactive with an electric switch 13 connected in a path 14, which, in turn, connects the output of said generator to its conductor 11 or 12, as the case may be.

Connected to conductor 11 is a quality control, or wave filter system 15 to which oscillations from generators 10 associated with pedals, A, B and C are transmitted in response to close circuiting their coactive electric switches 13, when depressing said pedals. A quality control system suitable for the purpose of my invention is disclosed in U. S. Letters Patent to M. J. Larsen, No. 2,403,090, dated July 2, 1940, the same having means such as the herein disclosed conductors 14a adapted to be connected in the outputs of respective wave filters of said system. In substantially the same manner, output conductors 17 common to the playing-keys of the manual connect with a quality control 16 having conductors 17 from respective wave filters.

The aforementioned quality controls 15 and 16 are so formed and designed that waveforms of oscillations appearing on each of said conductors 14 and similarly on each of said conductors 17 differ in their harmonic composition above the fundamental frequency components of said oscillations, the output from any conductor

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to be used either singly or mixed with the output from any other conductor or conductors. When predetermined waveforms from selected conductors are mixed, the resultant waveform is pre-calculated to approximate a tone of given timbre.

Referring now more particularly to the pedal keyboard of the instrument, it is noted that "stops" 18, 19 and 20 each embody an electric switch 21 which interconnects a collector 22 with given conductors 14a by decoupling resistances 23 of predetermined values, such that on close circuiting a selected switch 21, a mixture of waveforms of oscillations is impressed on collector 22.

Collector 22 terminates at ground through resistor 25 forming part of a mesh 25a, which mesh includes a resistor 26 of 10,000 ohms and a resistor 27 of 50,000 ohms connected across resistor 26 and constituting a voltage divider. Tapped to resistor 27 at predetermined points are channels 28, 29 and 30, each having an electric switch 32. The output terminal of each of said channels is connected to a conductor 33 which terminates at the input side of a main volume control 34, such as a potentiometer having an overall resistance of 5,000 ohms connected to the input of a translating device which includes amplifier 35 and loud speaker 36.

Stops 37, 38 and 39, similar in kind and purpose to stops 18, 19 and 20, connect given output conductors 17 from quality control 16 to conductor 39 by respective electric switches 40, 41 and 42, and, as shown, said conductor 39 connects with conductor 33 of mesh 25a whereby output oscillations from said quality control 16 are fed to said potentiometer 34.

The generators 10 may be of any well known type. Those disclosed in the aforementioned Larsen patent have been used with the required success as they produce waveforms of oscillations which are rich in harmonics.

The gist of my invention finds expression in means in an electric or electronic organ for preventing unpleasant overweighing of tones elicited from the manual keys by tones elicited from the pedals. In the more expensive pipe organs this is accomplished by a pedal organ and associated swell which is independent of the manuals and their swells. In such case, the loudness of tones elicited from the pedal organ is under such control of the player that the relative volumes of sound can be more correctly graded. My invention provides for a wide range of intensity variations in pedal tones regardless of the "stop" drawn, thus enabling any desired variation in intensity necessary for correct balancing of tones. It will be borne in mind that waveforms of oscillations effective in mesh 25a, when close circuiting any selected "stop" switch 18, 19 or 20 will comprise only those harmonics of fundamentals that have passed respective wave filters of the quality control 15 and that by reason of said decoupling resistors 23 between said switch and coactive conductors 14a from said filters, the resultant mixture received at said mesh will consist of a plurality of waveforms, the relative amplitudes of which have thus been fixed. When an impedance is placed in the path between a "stop" switch 21 as when close circuiting a selected switch 32, the overall volume of the mixture is either increased or decreased to a predetermined level. As distinguished from the modus operandi of mesh 25a, any waveform of oscillations or mixture of different waveforms of oscillations from quality control 16 passes un-

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impeded to main volume control 34. Pedal tones and manual tones are thus correctly proportioned at the instant the oscillations arrive at said main volume control. Therefore, upon exercising proper musical taste in selecting a pedal tone intensity, lack of balance and proportion between pedal and manual tones heretofore experienced with instruments of the prior art will be avoided and a balance obtained that will enable a skilled organist correctly to interpret music as it is intended to be played.

What I claim as my invention is:

1. In a musical instrument having tone signal generators and at least two separate sets of selectors, an electrical network in which said generators and said selectors are connected for impressing signals from selected generators on separate paths in said network, translating means in the output of said network and including a volume control device connected to one of said paths, and means for selectively interconnecting the other of said paths with said volume control device by any one of a plurality of channels of respectively different resistances for determining the amplitude of signals conducted to said volume control device from said other path.

2. A musical instrument as set forth in claim 1, and in which said different resistances are provided by a voltage divider connected across said other path and said separate channels are tapped thereto at predetermined points and wherein certain at least of said paths are each thereof provided with a selectively actuatable electric switch.

3. A musical instrument as set forth in claim 1, and in which said different resistances are provided by a voltage divider connected across said other path and said channels are each thereof to said voltage divider at predetermined points and wherein certain, at least of said channels are each provided with an electric switch according to which of said channels is desired to be close circuited with said volume control device, said separate paths being common to the outputs of all of said generators.

4. A musical instrument provided with generators producing complex waveforms of electrical oscillations at the tone frequencies of different notes of a musical scale, means for translating said waveforms of oscillations into audible sounds; a keyboard, the playing-keys of which are provided with electric switches interconnecting given ones of said generators with said translating means; a volume control device in the input circuit of said translating means; means including a conductor interposed between said volume control device and the switches of said keyboard for converting said waveforms of oscillations into waveforms corresponding to tones of any desired timbre; a pedal clavier, the playing-keys of which are provided with electric switches connecting given ones of said generators to means for converting output oscillations into waveforms corresponding to tones of any desired timbre and for impressing same upon a common conductor; and means interconnecting said common conductor with said volume control device for selectively varying the amplitude of waveforms of oscillations impressed on said volume device in response to actuation of selected playing-keys of said pedal clavier.

5. In a musical instrument employing oscillatory circuits producing audio signals at different tone frequencies; an electroacoustical translating system having a volume control device in its input circuit; a manual including means con-

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necting preassigned ones of said oscillatory circuits to said volume control device for selective transmission of audio signals thereto; and a pedal keyboard having means for connecting preassigned ones of said oscillatory circuits to said volume control device by resistive channels for controlling at will the intensity of audio signals transmitted to said volume control device in response to actuation of the pedals of said pedal keyboard.

6. An electronic musical instrument employing tone frequency generators, an electro-acoustical translating device, an electrical network and separate sets of tone selectors connected in said network for selectively close circuiting selected generators with said translating device in response to actuation of any selectors of said separate sets of selectors, said instrument comprising a set of stops for each separate set of said selectors for predetermining the quality of tone elicited from said translating device and a resistive mesh interconnecting the stops of one of said sets of se-

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lectors with said translating device by separate selectively controlled paths, each having a predetermined resistance therein, whereby the amplitude of tones of any given quality elicited from said translating device upon actuation of said selectors can be varied as desired relative to the amplitude of tones elicited from said translating device upon actuation of selectors of the other set of said selectors.

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